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## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

|  |   |
|--|---|
| Date of mailing (day/month/year)<br>23 June 2000 (23.06.00)                |   |
| International application No.<br>PCT/KR99/00567                            | Applicant's or agent's file reference<br>HM-12029-PCT         |
| International filing date (day/month/year)<br>20 September 1999 (20.09.99) | Priority date (day/month/year)<br>07 November 1998 (07.11.98) |
| Applicant<br>HAN, Man, Yop   |   |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
 07 June 2000 (07.06.00)

☐ in a notice effecting later election filed with the International Bureau on:  
 \_\_\_\_\_

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

|   |   |
|---|---|
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland<br><br>Facsimile No.: (41-22) 740.14.35 | Authorized officer<br><br>Olivia RANAIVOJAONA<br><br>Telephone No.: (41-22) 338.83.38 |
|---|---|

# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (if desired) (12 characters maximum) HM-12029-PCT

|   |  |
|---|--|
| <b>Box No. I TITLE OF INVENTION</b>   |  |
| TENSION FORCE ADJUSTABLE PRESTRESSED GIRDER   |  |
| <b>Box No. II APPLICANT</b>   |  |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)     |  |
| INTERCONSTEC CO., LTD.<br>501 Asan Building, 1665-9 Seocho-dong, Seocho-gu<br>Seoul, 137-070 Republic of Korea  |  |
| <input type="checkbox"/> This person is also inventor.  |  |
| Telephone No.<br>02) 598-2416   |  |
| Facsimile No.<br>02) 3486-0996  |  |
| Teleprinter No.   |  |
| State (that is, country) of nationality:<br>KR  | State (that is, country) of residence:<br>KR |
| This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box |  |
| <b>Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)</b>  |  |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)     |  |
| HAN Man Yop<br>304-1302 Sunkyung Apt., Inkye-dong, Paldal-gu<br>Suwon-city, Kyungki-do, 442-070 Republic of Korea   |  |
| This person is:<br><input type="checkbox"/> applicant only<br><input checked="" type="checkbox"/> applicant and inventor<br><input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)   |  |
| State (that is, country) of nationality:<br>KR  | State (that is, country) of residence:<br>KR |
| This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box |  |
| <input type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.   |  |
| <b>Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE</b>   |  |
| The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative   |  |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  |  |
| LEE Young Pil<br>The Cheonghwa Bldg., 1571-18 Seocho-dong<br>Seocho-gu, Seoul, 137-073 Republic of Korea  |  |
| Telephone No.<br>02) 588-8585, 598-7211   |  |
| Facsimile No.<br>02) 588-8547/8   |  |
| Teleprinter No.   |  |
| <input type="checkbox"/> Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.  |  |

| Box No.V  | DESIGNATION OF STATES  |
|---|--|
| The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):  |  |
| <b>Regional Patent</b>  |  |
| <input checked="" type="checkbox"/> AP  | ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT  |
| <input checked="" type="checkbox"/> EA  | Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT   |
| <input checked="" type="checkbox"/> EP  | European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT          |
| <input checked="" type="checkbox"/> OA  | OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) |
| <b>National Patent (if other kind of protection or treatment desired, specify on dotted line):</b>  |  |
| <input checked="" type="checkbox"/> AE  | United Arab Emirates   |
| <input checked="" type="checkbox"/> AL  | Albania  |
| <input checked="" type="checkbox"/> AM  | Armenia  |
| <input checked="" type="checkbox"/> AT  | Austria  |
| <input checked="" type="checkbox"/> AU  | Australia  |
| <input checked="" type="checkbox"/> AZ  | Azerbaijan   |
| <input checked="" type="checkbox"/> BA  | Bosnia and Herzegovina   |
| <input checked="" type="checkbox"/> BB  | Barbados   |
| <input checked="" type="checkbox"/> BG  | Bulgaria   |
| <input checked="" type="checkbox"/> BR  | Brazil   |
| <input checked="" type="checkbox"/> BY  | Belarus  |
| <input checked="" type="checkbox"/> CA  | Canada   |
| <input checked="" type="checkbox"/> CH and LI   | Switzerland and Liechtenstein  |
| <input checked="" type="checkbox"/> CN  | China  |
| <input checked="" type="checkbox"/> CU  | Cuba   |
| <input checked="" type="checkbox"/> CZ  | Czech Republic   |
| <input checked="" type="checkbox"/> DE  | Germany  |
| <input checked="" type="checkbox"/> DK  | Denmark  |
| <input checked="" type="checkbox"/> EE  | Estonia  |
| <input checked="" type="checkbox"/> ES  | Spain  |
| <input checked="" type="checkbox"/> FI  | Finland  |
| <input checked="" type="checkbox"/> GB  | United Kingdom   |
| <input checked="" type="checkbox"/> GD  | Grenada  |
| <input checked="" type="checkbox"/> GE  | Georgia  |
| <input checked="" type="checkbox"/> GH  | Ghana  |
| <input checked="" type="checkbox"/> GM  | Gambia   |
| <input checked="" type="checkbox"/> HR  | Croatia  |
| <input checked="" type="checkbox"/> HU  | Hungary  |
| <input checked="" type="checkbox"/> ID  | Indonesia  |
| <input checked="" type="checkbox"/> IL  | Israel   |
| <input checked="" type="checkbox"/> IN  | India  |
| <input checked="" type="checkbox"/> IS  | Iceland  |
| <input checked="" type="checkbox"/> JP  | Japan  |
| <input checked="" type="checkbox"/> KE  | Kenya  |
| <input checked="" type="checkbox"/> KG  | Kyrgyzstan   |
| <input checked="" type="checkbox"/> KP  | Democratic People's Republic of Korea  |
| <input type="checkbox"/> KR   | Republic of Korea  |
| <input checked="" type="checkbox"/> KZ  | Kazakhstan   |
| <input checked="" type="checkbox"/> LC  | Saint Lucia  |
| <input checked="" type="checkbox"/> LK  | Sri Lanka  |
| <input checked="" type="checkbox"/> LR  | Liberia  |
| <input checked="" type="checkbox"/> LS  | Lesotho  |
| <input checked="" type="checkbox"/> LT  | Lithuania  |
| <input checked="" type="checkbox"/> LU  | Luxembourg   |
| <input checked="" type="checkbox"/> LV  | Latvia   |
| <input checked="" type="checkbox"/> MD  | Republic of Moldova  |
| <input checked="" type="checkbox"/> MG  | Madagascar   |
| <input checked="" type="checkbox"/> MK  | The former Yugoslav Republic of Macedonia  |
| <input checked="" type="checkbox"/> MN  | Mongolia   |
| <input checked="" type="checkbox"/> MW  | Malawi   |
| <input checked="" type="checkbox"/> MX  | Mexico   |
| <input checked="" type="checkbox"/> NO  | Norway   |
| <input checked="" type="checkbox"/> NZ  | New Zealand  |
| <input checked="" type="checkbox"/> PL  | Poland   |
| <input checked="" type="checkbox"/> PT  | Portugal   |
| <input checked="" type="checkbox"/> RO  | Romania  |
| <input checked="" type="checkbox"/> RU  | Russian Federation   |
| <input checked="" type="checkbox"/> SD  | Sudan  |
| <input checked="" type="checkbox"/> SE  | Sweden   |
| <input checked="" type="checkbox"/> SG  | Singapore  |
| <input checked="" type="checkbox"/> SI  | Slovenia   |
| <input checked="" type="checkbox"/> SK  | Slovakia   |
| <input checked="" type="checkbox"/> SL  | Sierra Leone   |
| <input checked="" type="checkbox"/> TJ  | Tajikistan   |
| <input checked="" type="checkbox"/> TM  | Turkmenistan   |
| <input checked="" type="checkbox"/> TR  | Turkey   |
| <input checked="" type="checkbox"/> TT  | Trinidad and Tobago  |
| <input checked="" type="checkbox"/> UA  | Ukraine  |
| <input checked="" type="checkbox"/> UG  | Uganda   |
| <input checked="" type="checkbox"/> US  | United States of America   |
| <input checked="" type="checkbox"/> UZ  | Uzbekistan   |
| <input checked="" type="checkbox"/> VN  | Viet Nam   |
| <input checked="" type="checkbox"/> YU  | Yugoslavia   |
| <input checked="" type="checkbox"/> ZA  | South Africa   |
| <input checked="" type="checkbox"/> ZW  | Zimbabwe   |
| <input type="checkbox"/>  | Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:   |
| <input type="checkbox"/>  |  |
| <input type="checkbox"/>  |  |
| <p><b>Precautionary Designation Statement:</b> In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)</p> |  |


| <b>Box No. VI PRIORITY CLAIM</b>                       |                               | <input type="checkbox"/> Further priority claims are indicated in the Supplemental Box. |  |  |
|--|-------------------------------|---|--|--|
| Filing date of earlier application<br>(day/month/year) | Number of earlier application | Where earlier application is:   |  |  |
|  |                               | national application:<br>country  | regional application:<br>regional Office | international application:<br>receiving Office |
| item (1)<br>7 November 1998<br>(07.11.98)              | 1998-47661                    | KR  |  |  |
| item (2)   |                               |   |  |  |
| item (3)   |                               |   |  |  |

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

|  |  |  |                                     |
|--|--|--|-------------------------------------|
| <b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>   |  |  |                                     |
| Choice of International Searching Authority (ISA)<br>(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): |  | Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority): |                                     |
| ISA / AT   |  | Date (day/month/year)  | Number Country (or regional Office) |

|  |  |
|--|--|
| <b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>   |  |
| This international application contains the following number of sheets:<br>request : 3<br>description (excluding sequence listing part) : 9<br>claims : 2<br>abstract : 1<br>drawings : 8<br>sequence listing part of description :<br>Total number of sheets : 23 | This international application is accompanied by the item(s) marked below:<br>1. <input checked="" type="checkbox"/> fee calculation sheet<br>2. <input type="checkbox"/> separate signed power of attorney<br>3. <input type="checkbox"/> copy of general power of attorney; reference number, if any:<br>4. <input type="checkbox"/> statement explaining lack of signature<br>5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):<br>6. <input type="checkbox"/> translation of international application into (language):<br>7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material<br>8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form<br>9. <input type="checkbox"/> other (specify): |
| Figure of the drawings which should accompany the abstract: FIG. 3A  | Language of filing of the international application: English   |

|   |  |
|---|--|
| <b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>   |  |
| <small>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</small> |  |
| LEE Young Pil<br>  |  |

|  |  |
|--|--|
| <b>For receiving Office use only</b>   |  |
| 1. Date of actual receipt of the purported international application:<br>3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:<br>4. Date of timely receipt of the required corrections under PCT Article 11(2):<br>5. International Searching Authority (if two or more are competent): ISA / | 2. Drawings:<br><input type="checkbox"/> received:<br><input type="checkbox"/> not received: |
| 6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.   |  |

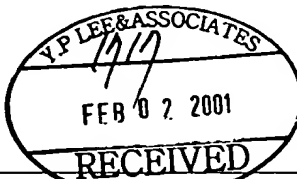
|   |  |
|---|--|
| <b>For International Bureau use only</b>                        |  |
| Date of receipt of the record copy by the International Bureau: |  |

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

LEE Young-Pil  
The Cheonghwa Building, 1571-18  
Seocho-dong, Seocho-gu  
Seoul, 137-073  
Republic of Korea



## PCT

### WRITTEN OPINION

(PCT Rule 66)

F

Applicant's or agent's file reference

HM-12029-PCT

FAX No. 1371

Date of mailing

(day/month/year) 29 January 2001 (29.01.01)

REPLY DUE

within 1 months/days from  
the above date of mailing

International application No.

PCT/KR 99/00567

International filing date (day/month/year)

20 September 1999 (20.09.99)

Priority date (day/month/year)

07 November 1998 (07.11.98)

International Patent Classification (IPC) or both national classification and IPC

IPC<sup>7</sup>: E04C 3/26

Applicant

Interconstec Co., Ltd. et al.

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
  - I. ☒ Basis of the opinion
  - II. ☐ Priority
  - III. ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV. ☐ Lack of unity of invention
  - V. ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI. ☐ Certain documents cited
  - VII. ☐ Certain defects in the international application
  - VIII. ☐ Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.
 

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.  
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 07 March 2001 (07.03.01).

Name and mailing address of the IPEA/AT  
Austrian Patent Office  
Kohlmarkt 8-10; A-1014 Vienna

Facsimile No. 1/53424/200

Form PCT/IPEA/408 (cover sheet) (July 1998)

Authorized officer

Sengschmitt

Telephone No. 1/53424/384

WRITTEN OPINION

International application No.

PCT/KR 99/00567

**I. Basis of the opinion**

1. With regard to the elements of the international application:\*

☒ the international application as originally filed

☐ the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under Article 19

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the drawings:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as „originally filed“.

**WRITTEN OPINION**

International application No.  
PCT/KR 99/00567

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

|                               |        |     |     |
|-------------------------------|--------|-----|-----|
| Novelty (N)                   | Claims | 1-6 | YES |
|                               | Claims | -   | NO  |
| Inventive step (IS)           | Claims | -   | YES |
|                               | Claims | 1-6 | NO  |
| Industrial applicability (IA) | Claims | 1-6 | YES |
|                               | Claims | -   | NO  |

**2. Citations and explanations**

The following documents have been considered for the purpose of this written opinion:

D1: US 5671572

D2: EIBL Josef. Externe Vorspannung und Segmentbauweise

Document D1 describes a method for externally reinforcing girders with the help of external tension members. Document D2 describes the experience of externally prestressed segment-bridges built in Germany. Also the possibility of laying so called monostrands within said bridges (in opposite to external prestressing) is discussed in D1 (see e.g. page 81, line 7- 10). The possibility of changing said monostrands during or after construction is also pointed out. Therefore, a combination of document D1 and D2 leads for a person skilled in the art to the subject matter of independent claims 1 of the presented application (tensioning so called non-tension steel wires) and also to the subject matter of independent claim 5 and dependent claim 6 of the presented application (tensioning so called non-tension steel wires during construction and /or after construction thereof). Consequently claims 1, 5 and 6 of the presented application do not involve an inventive step. Dependent claims 2 and 3 of the presented application describe a coupling member and also the way of fixing said wires which is commonly used in similar embodiments and do therefore not involve an inventive step. Dependent claim 4 describes also a commonly used way of applying a tension force to tension steel wires and can therefore not considered to be inventive as well.

In conclusion, claims 1 to 6 can be considered to be new but do not involve an inventive step.

The industrial applicability is given for all claims.

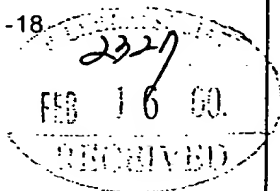


From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

LEE Young-Pil  
The Cheonghwa Building, 1571-18  
Seocho-dong, Seocho-gu  
Seoul, 137-073  
Republic of Korea



NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR THE DECLARATION

(PCT Rule 44.1)

|  |   |
|--|---|
| Date of mailing<br>(day/month/year) 9 Feb. 2000 (09.02.00) |   |
| Applicant's or agent's file reference<br>HM-12029-PCT      | <b>FOR FURTHER ACTION</b> See paragraphs 1 and 4 below                |
| International application No.<br>PCT / KR 99/00567         | International filing date<br>(day/month/year) 20 Sep. 1999 (20.09.99) |
| Applicant<br>INTERCONSTEC CO., LTD. et al.                 |   |

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.  
**Filing of amendments and statement under Article 19:**  
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):  
 When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.  
 Where? Directly to the International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland  
 Facsimile No.: (41-22) 740.14.35  
 For more detailed instructions, see the notes on the accompanying sheet.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
  - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
  - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Further action(s):** The applicant is reminded of the following:
 

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

|  |  |
|--|--|
| Name and mailing address of the ISA/ AT<br>AUSTRIAN PATENT OFFICE<br>Kohlmarkt 8-10<br>A-1014 Vienna<br>Facsimile No. +43 / 1 / 534 24 - 200 | Authorized officer<br>Koch<br>Telephone No. +43 / 1 / 534 24 - 450 |
|--|--|

## NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

### INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

#### What parts of the international application may be amended ?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

**When ?** Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

#### Where not to file the amendments ?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

**How ?** Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

#### What documents must/may accompany the amendments ?

##### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

## NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

### "Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

### Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

### Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicant's Guide*, Volume II.

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

|   |  |   |
|---|--|---|
| Applicant's or agent's file reference<br>HM-12029-PCT | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |   |
| International application No.<br>PCT/KR 99/00567      | International filing date ( <i>day/month/year</i> )<br>20 September 1999 (20.09.99)  | (Earliest) Priority Date ( <i>day/month/year</i> )<br>07 November 1998 (07.11.98) |
| Applicant<br>INTERCONSTEC CO., LTD. et al.            |  |   |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

**This international search report consists of a total of 3 sheets.**

☐ It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

1. **Basis of the report**
- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
2. ☐ **Certain claims were found unsearchable (See Box I).**
3. ☐ **Unity of invention is lacking (See Box II).**
4. **With regard to the title,**
- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established by this Authority to read as follows:
5. **With regard to the abstract,**
- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. **The figure of the drawings to be published with the abstract is Figure No.:** 3A
- ☒ as suggested by the applicant.
- ☐ because the applicant failed to suggest a figure.
- ☐ because this figure better characterizes the invention.
- ☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 99/00567

## A. CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: E 04 C 3/26; E 04 C 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC<sup>7</sup>: E 04 C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | EIBL, Josef. Externe Vorspannung und Segmentbauweise: Vorträge anlässlich des Workshops "Externe und verbundlose Vorspannung - Segmentbrücken" an der Universität Fridericiana Karlsruhe (TH) vom 5 -7. Okt. 1998. Berlin: Ernst, 1998, pages 71 to 83, especially pages 72 and 81 and fig.15. | 1,5,6                 |
| Y         | US 5671572 (JOSE LUIS SILLER-FRANCO), 30 September 1997 (30.09.97), fig.1; description.  | 1,5,6                 |
| A         | US 4604003 (RONALD A. FRANCOEUR), 05 August 1986 (05.08.86), claim 1; fig.11.  | 3,4                   |
| A         | US 5313749 (MITCHEL A. CONNER), 24 May 1994 (24.05.94), whole abstract.  | 1-6                   |
| A         | US 4831800 (LUCIAN I. NEDELCU), 23 May 1989 (23.05.89), totality.  | 1-6                   |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

„A“ document defining the general state of the art which is not considered to be of particular relevance

„E“ earlier application or patent but published on or after the international filing date

„L“ document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

„O“ document referring to an oral disclosure, use, exhibition or other means

„P“ document published prior to the international filing date but later than the priority date claimed

„T“ later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

„X“ document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

„Y“ document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

„&“ document member of the same patent family

Date of the actual completion of the international search

14 January 2000 (14.01.00)

Date of mailing of the international search report

09 February 2000 (09.02.00)

Name and mailing address of the ISA/AT

Austrian Patent Office  
Kohlmarkt 8-10; A-1014 Vienna  
Facsimile No. 1/53424/200

Authorized officer

Sengschmitt

Telephone No. 1/53424/384

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR 99/00567

| Patent document cited<br>in search report |   |         | Publication<br>date | Patent family<br>member(s) |    | Publication<br>date |
|---|---|---------|---------------------|----------------------------|----|---------------------|
| US  | A | 5671572 | 30-09-1997          | none                       |    |                     |
| US  | A | 4604003 | 05-08-1986          | none                       |    |                     |
| US  | A | 5313749 | 24-05-1994          | AU                         | A1 | 41171/93            |
|   |   |         |                     | AU                         | B2 | 689074              |
|   |   |         |                     | BR                         | A  | 9306292             |
|   |   |         |                     | CA                         | C  | 2134212             |
|   |   |         |                     | CN                         | A  | 1078283             |
|   |   |         |                     | EP                         | A1 | 638136              |
|   |   |         |                     | EP                         | A4 | 638136              |
|   |   |         |                     | MX                         | A1 | 9302485             |
|   |   |         |                     | WO                         | A1 | 9322521             |
| US  | A | 4831800 | 23-05-1989          | none                       |    |                     |
|   |   |         |                     |                            |    | 29-11-1993          |
|   |   |         |                     |                            |    | 26-03-1998          |
|   |   |         |                     |                            |    | 30-06-1998          |
|   |   |         |                     |                            |    | 06-04-1999          |
|   |   |         |                     |                            |    | 10-11-1993          |
|   |   |         |                     |                            |    | 15-02-1995          |
|   |   |         |                     |                            |    | 19-04-1995          |
|   |   |         |                     |                            |    | 31-05-1994          |
|   |   |         |                     |                            |    | 11-11-1993          |

# PATENT COOPERATION TREATY

## PCT

REGD 07 DEC 2001

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

PCT

(PCT Article 36 and Rule 70)

9/831337

|  |   |  |
|--|---|--|
| Applicant's or agent's file reference<br>HM-12029-PCT  | <b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |  |
| International application No.<br>PCT/KR 99/00567   | International filing date (day month year)<br>20 September 1999<br>(20.09.1999)   | Priority Date (day month year)<br>7 November 1998 (07.11.1998) |
| International Patent Classification (IPC) or national classification and IPC<br><br>IPC <sup>7</sup> : E04C 3/26 |   |  |
| Applicant<br>INTERCONSTEC CO., LTD. et al.   |   |  |

- This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 4 sheets, including this cover sheet.  
  
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

- This report contains indications relating to the following items:

- I. ☒ Basis of the opinion
- II. ☐ Priority
- III. ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV. ☐ Lack of unity of invention
- V. ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement
- VI. ☐ Certain documents cited
- VII. ☐ Certain defects in the international application
- VIII. ☐ Certain observations on the international application

RECEIVED  
FEB 19 2002  
GROUP 3600

|   |  |
|---|--|
| Date of submission of the demand<br><br>7 June 2000 (07.06.2000)  | Date of completion of this report<br><br>9 November 2001 (09.11.2001)  |
| Name and mailing address of the IPEA/AT<br>Austrian Patent Office<br>Kohlmarkt 8-10<br>A-1014 Vienna<br>Facsimile No. 1/53424/200 | Authorized officer<br><br>SENGSCHMITT<br><br>Telephone No. 1/53424/384 |

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

PCT/KR 99/00567

## I. Basis of the report

1. With regard to the **elements** of the international application:\*

- ☒ the international application as originally filed
- ☐ the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the claims:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, as amended (together with any statement) under Article 19  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_.
- ☐ the claims, Nos. \_\_\_\_\_.
- ☐ the drawings, sheets/fig \_\_\_\_\_.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/KR 99/00567

|   |                               |            |     |
|---|-------------------------------|------------|-----|
| V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement  |                               |            |     |
| I. Statement  | Novelty (N)                   | Claims 1-6 | YES |
|   |                               | Claims     | NO  |
|   | Inventive step (IS)           | Claims 1-6 | YES |
|   |                               | Claims     | NO  |
|   | Industrial applicability (IA) | Claims 1-6 | YES |
|   |                               | Claims     | NO  |
| Citations and explanations (Rule 70.7)  |                               |            |     |
| <p>The documents cited in the search report are:</p> <p>D1: US 5671572 A<br/>D2: EIBL Josef. Externe Vorspannung und Segmentbauweise</p> <p>Though the Search Report in context with the Written Opinion transmitted to the Applicant raised severe objections with respect to the inventiveness as well as obviousness pertinent to claims 1 – 6 of the present application, the Applicant did not submit any response thereto.</p> <p>Therefore, in view of the cited state of the art, the lack of inventiveness regarding said claims, as reasoned in the 1<sup>st</sup> Written Opinion, has to be maintained.</p> <p>Text of the 1<sup>st</sup> Written Opinion:</p> <p>Document D1 describes a method for externally reinforcing girders with the help of external tension members. Document D2 describes the experience of externally prestressed segment-bridges built in Germany. Also the possibility of laying so called monostrands within said bridges (in opposite to external prestressing) is discussed in D1 (see e.g. page 81, line 7- 10). The possibility of changing said monostrands during or after construction is also pointed out. Therefore, a combination of document D1 and D2 leads for a person skilled in the art to the subject matter of independent claims 1 of the presented application (tensioning so called non-tension steel wires) and also to the subject matter of independent claim 5 and dependent claim 6 of the presented application (tensioning so called non-tension steel wires during construction and /or after construction thereof). Consequently claims 1, 5 and 6 of the presented application do not involve an inventive step. Dependent claims 2 and 3 of the presented application describe a coupling member and also the way of fixing said wires which is commonly used in similar embodiments and do therefore not involve an inventive step. Dependent claim 4 describes also a commonly used way of applying a tension force to tension steel wires and can therefore not considered to be inventive as well.</p> |                               |            |     |

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/KR 99/00567

## Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: **Box V (page 1)**

In conclusion, claims 1 to 6 can be considered to be new but do not involve an inventive step.

The industrial applicability is given for all claims.

## PCT COOPERATION TREATY

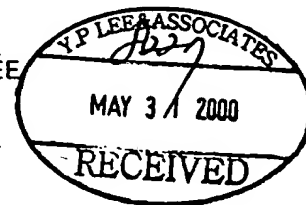
PCT

NOTICE INFORMING THE APPLICANT OF THE  
COMMUNICATION OF THE INTERNATIONAL  
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

LEE, Young, Pil  
The Cheonghwa Building  
1571-18 Seocho-dong  
Seocho-gu  
Seoul 137-073  
RÉPUBLIQUE DE CORÉE

|  |  |   |  |
|--|--|---|--|
| Date of mailing (day/month/year)<br>18 May 2000 (18.05.00) |  | IMPORTANT NOTICE  |  |
| Applicant's or agent's file reference<br>HM-12029-PCT      |  |   |  |
| International application No.<br>PCT/KR99/00567            | International filing date (day/month/year)<br>20 September 1999 (20.09.99) | Priority date (day/month/year)<br>07 November 1998 (07.11.98) |  |
| Applicant<br>INTERCONSTEC CO., LTD. et al                  |  |   |  |

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:  
AU,CN,JP,KP,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:  
AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CU,CZ,DE,DK,EA,EE,EP,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW  
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).
3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 18 May 2000 (18.05.00) under No. WO 00/28168

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

|   |                                 |
|---|---------------------------------|
| The International Bureau of WIPO<br>34, chemin des Colombettes<br>1211 Geneva 20, Switzerland | Authorized officer<br>J. Zahra  |
| Facsimile No. (41-22) 740.14.35   | Telephone No. (41-22) 338.83.38 |

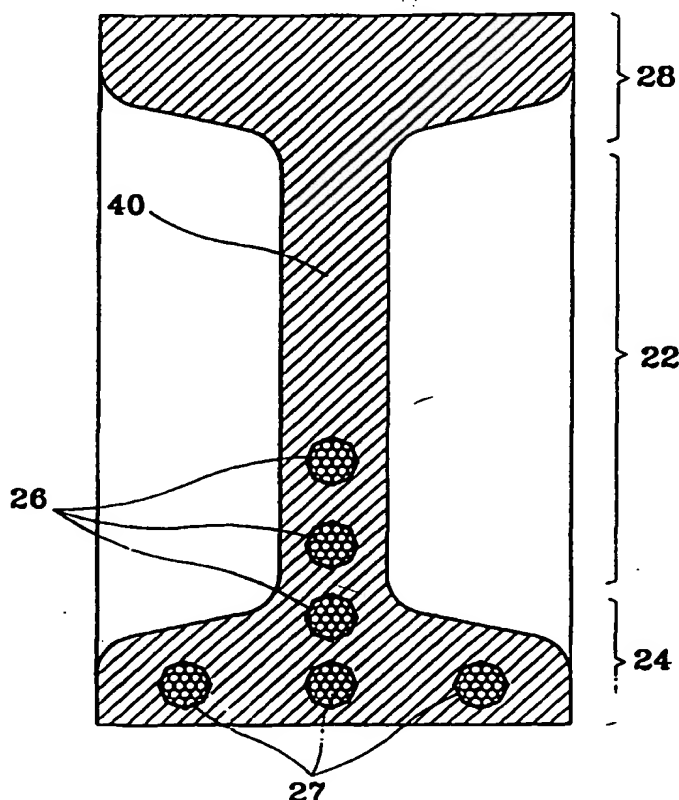


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|  |           |  |
|--|-----------|--|
| <b>(51) International Patent Classification <sup>7</sup> :</b><br><b>E04C 3/26, 5/08</b>   | <b>A1</b> | <b>(11) International Publication Number:</b> <b>WO 00/28168</b><br><b>(43) International Publication Date:</b> <b>18 May 2000 (18.05.00)</b>  |
| <b>(21) International Application Number:</b> PCT/KR99/00567<br><b>(22) International Filing Date:</b> 20 September 1999 (20.09.99)<br><b>(30) Priority Data:</b><br>1998/47661                      7 November 1998 (07.11.98)      KR<br><b>(71) Applicant (for all designated States except US):</b> INTERCON-<br>STEC CO., LTD. [KR/KR]; 501 Asan Building, 1665-9<br>Seocho-dong, Seocho-gu, Seoul 137-070 (KR).<br><b>(72) Inventor; and</b><br><b>(75) Inventor/Applicant (for US only):</b> HAN, Man, Yop [KR/KR];<br>304-1302 Sunkyung Apt., Inkye-dong, Paldal-gu, Su-<br>won-city, Kyungki-do 442-070 (KR).<br><b>(74) Agent:</b> LEE, Young, Pil; The Cheonghwa Building, 1571-18<br>Seocho-dong, Seocho-gu, Seoul 137-073 (KR). |           | <b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG,<br>BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB,<br>GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG,<br>KP, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK,<br>MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG,<br>SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU,<br>ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL,<br>SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ,<br>MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE,<br>DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE),<br>OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML,<br>MR, NE, SN, TD, TG).<br><br>Published<br>With international search report. |

**(54) Title:** TENSION FORCE ADJUSTABLE PRESTRESSED GIRDER**(57) Abstract**

A tension force adjustable prestressed girder is disclosed which can compensate for sagging or cracks of a girder generated due to overload or long-term creep or increase a load-resisting force of a bridge or a building. The tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange (28) supporting an upper deck of a bridge installed thereon, a body portion (22), and a lower flange (24) which includes tension steel wires (27) provided in a lengthwise direction of the girder (40) and tensioned to compensate for the load-resisting force, and at least one or more non-tension steel wires (27a) provided in the lengthwise direction of the girder, so that the load-resisting force of the bridge or building can be increased by tensioning the non-tension steel wires. Thus, cracks and sagging of a girder generated due to long-term deterioration, creep or overload can be corrected by additionally tensioning steel wires installed internally or externally at a girder of the bridge or building. Thus, repair and reinforcement of the bridge or building is easy so that the load-resisting force of the bridge or building can be easily increased. Also, by adjusting the tension force step by step, the girder can be economically manufactured or the height of the girder can be decreased.



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## TENSION FORCE ADJUSTABLE PRESTRESSED GIRDER

### Technical Field

The present invention relates to a girder, and more particularly, to  
5 a tension force adjustable prestressed girder which can compensate for  
sagging or cracks of a girder generated due to a long-term load and is  
capable of adjusting a tension force by increasing a load-resisting force of  
a bridge or building, if necessary, after the construction thereof.

### 10 Background Art

In general, when girders installed on a column of a concrete bridge  
become obsolete as time passes or heavy vehicles exceeding the originally  
designed weight allowance of a bridge pass over the bridge for a prolonged  
period, the beam of the bridge may become damaged and an excessive  
15 sagging may occur at the girders. Concurrently, bending/tensile cracks are  
generated and, when such damage continues, the bridge may ultimately  
collapse. Thus, appropriate repair and reinforcement of the bridge is  
required.

Meanwhile, a prestressed concrete (PSC) bridge is repaired and  
20 reinforced by means of an external steel wire reinforcement construction  
method. According to the above reinforcement construction method, an  
externally installed steel wire is to be fixed appropriately at an end portion  
of a girder. However, it is difficult to install a wire fixing apparatus at the  
end portion of a girder and reliability on the load-resisting force of the wire  
25 fixing apparatus is not assured. Thus, although other methods have been  
suggested and applied, no effective apparatuses have been developed yet.  
That is, when cracks and sagging occur in a PCS bridge, it is very difficult  
to repair and reinforce the bridge.

Also, as the traffic volume continuously increases and automobile  
30 manufacturing technologies develop, the weight of a vehicle increases.  
With an increase in the weight of a vehicle, the specifications which is a  
standard of designing a bridge must be modified. Modifications of the

specifications necessarily results in an unbalanced load-resisting state, i.e., the load-resisting forces of the existing bridges are not matched. In other words, in a state in which roads allowing passage of heavy trucks and roads not allowing passage of heavy trucks exist together, the efficiency of transportation network system as a whole is severely lowered. Thus, to make the unbalanced load-resisting forces of these bridges consistent, an economical reinforcement method for upgrading the level of the bridge from 2 to 1 must be urgently found.

As the width of a road increases due to an increase in the number of lanes of a road, the development of a wide span girder for constructing an elevated road or an overpass crossing a wide road has proceeded. Although a preflex beam has been developed and used for the above purposes, conveying the girder is inconvenient due to the length thereof and because the costs are high.

Currently, high strength concrete is used for a girder less than 30 m long that is not a wide span girder. However, as a high tension force is applied to the girder, the amount of creep generated becomes great. As the creep increases, the girder sags further which directly affects the longitudinal alignment of the road. When the longitudinal alignment deteriorates, a coefficient of impact by passing vehicles increases. Thus, in the case of a high strength girder or a wide span girder, when the girder is used for a long time, an appropriate construction method for compensating for sagging of the girder is required.

Also, the height of a girder which is long in span is relatively high such that the girder itself is 2.00 m - 3.00 m high. Such a fact entails an increase in the height of an upper deck of an overpass so that, to secure a longitudinal alignment of the overpass matching the designed vehicle speed, the length of the overpass becomes longer, thus raising the construction costs. In the case of a bridge crossing a river, to lower the height of the girder as low as possible is inevitably needed for improving the usability and the economic value of the girder.

FIG. 1 shows the structure of a general bridge. As shown in the

drawing, a plurality of I-type girders 12 are installed on a column 10. An upper deck slab (not shown) is installed on the girders 12 of the bridge.

FIG. 2 is a sectional view showing a girder in which steel wires are arranged according to the conventional technology. As shown in the drawing, a girder 20 consists of a body portion 22, an upper flange 28, and a lower flange 24. A plurality of steel wires 26 are built in the body portion 22 in the lengthwise direction. An upper deck of a bridge is installed on the upper flange 28 and the bottom surface of the lower flange 24 is supported by the column 10.

After the I-type girder 20 according to the conventional technology is constructed, when the bridge is damaged, that is, sagging or cracks are generated due to the increased traffic volume passing over the bridge, or when the designed passage load must be increased according to the revision of the specifications, reinforcement of the bridge is required. However, there are no economical and reliable reinforcement methods applicable therefor.

#### Disclosure of the Invention

It is an objective of the present invention to provide a prestressed girder of which a tension force can be adjusted by adjusting a tension force of a steel wire provided in a body portion or lower flange of the girder to easily increase a load-resisting force of a bridge or building, when excessive sagging or cracks are generated in a girder due to long-term use or when there is a need to increase the load-resisting force of the bridge or building without damaging the bridge or building.

Accordingly, to achieve the above objective, there is provided a tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge installed thereon, a body portion, and a lower flange, which includes tension steel wires provided in a lengthwise direction of the girder and tensioned to compensate for the load-resisting force, and at least one or more non-tension steel wires provided in the lengthwise direction of the



girder, so that the load-resisting force of the bridge can be increased by tensioning the non-tension steel wires.

It is preferred in the present invention that the tension force adjustable prestressed girder further comprises a cut-open portion at a  
5 predetermined portion in the lengthwise direction of the girder and a coupling member installed at the cut-open portion for fixing one ends of the steel wires of which the other ends are fixed at an end portion of the girder.

According to another preferred embodiment of the present invention, there is provided a tension force adjustable prestressed girder for adjusting  
10 a load-resisting force which consists of an upper flange supporting an upper deck of a bridge installed thereon, a body portion, and a lower flange, which includes tension steel wires provided in a lengthwise direction of the girder and tensioned to compensate for the load-resisting force, and one or more non-tension steel wires provided in the lengthwise direction of  
15 the girder, so that the load-resisting force of the bridge can be increased by tensioning the non-tension steel wires during construction of the girder and/or after the construction thereof.

Although the present invention can be applied to any type of girder regardless of the shape of the section of the girder such as an I-type girder  
20 or a bulb T-type girder, the I-type girder is described in the below preferred embodiment.

#### Brief Description of the Drawings

FIG. 1 is a perspective view showing the structure of a general  
25 bridge;

FIG. 2 is a sectional view showing the arrangement of steel wires in the girder according to conventional technology;

FIG. 3A is a sectional view showing the arrangement of steel wires in the middle portion of a girder according to the present invention;

30 FIG. 3B is a sectional view showing the steel wires according to another preferred embodiment of the present invention;

FIG. 4A is a sectional view showing the arrangement of steel wires

at the end portion of the girder of FIG. 3A;

FIG. 4B is a sectional view showing the arrangement of steel wires at the end portion of the girder of FIG. 3B;

FIG. 5 is a view showing a cut-open portion located at the middle  
5 portion of the girder and the arrangement of the steel wires in the girder;

FIG. 6 is a side view showing an example of a steel wire fixed at the end portion of the girder; and

FIG. 7 is a perspective view showing an example of the steel wires in the cut-open portion.

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#### Best mode for carrying out the Invention

In FIG. 3A, a girder 40 includes an upper flange 28, a lower flange 24, and a body portion 22. One or more tension steel wires 26 and non-tension steel wires 27 are built in and across the lower portion of the body  
15 portion 22 and the lower flange 24 of the girder 40 in the lengthwise direction of the girder 40.

Preferably, the non-tension steel wires 27 are built in the lower flange 28 horizontally parallel to each other, as shown in FIG. 3A. The upper flange 28 is provided above the body portion 22 in the latitudinal  
20 direction in the section of the girder 40 and an upper deck of a bridge is installed on the upper flange 28. The lower flange 24 is provided below the body portion 22 in the latitudinal direction in the section of the girder 40 and the bottom surface thereof is supported by a column (not shown).

FIG. 3B shows a steel wire according to another preferred  
25 embodiment of the present invention. As shown in the drawing, a plurality of non-tension steel wires 27a are provided in the lengthwise direction of the girder 40 outside the lower portion of the body portion 22. The non-tension steel wires 27a have the same function as that of the non-tension steel wire 27 provided in the lower flange 24, as shown in FIG. 3A. That is,  
30 after a bridge is constructed, sagging of the girder 40 is compensated for by tensioning the non-tension steel wires 27a. Also, the non-tension steel wires 27a can be more easily installed compared to a case of being

installed inside the lower flange 24.

FIG. 4A shows the arrangement of the steel wires built in the girder of FIG. 3A. As shown in the drawing, the tension steel wires 26 and the non-tension steel wires 27 concentrated at the lower portion of the girder 40 are distributed throughout the entire sectional portion of the girder 40. That is, the steel wires are evenly distributed symmetrically in up/down and left/right sides of the girder 40 so that the tension force by the tension steel wires 26 and the non-tension steel wires 27 can be evenly distributed throughout the entire portion of the girder 40.

FIG. 4B shows the arrangement of the steel wires at the end portion of the girder shown in FIG. 3B. As shown in the drawing, the tension steel wires 26 or the non-tension steel wires 27 and 27a concentrated at the lower portion of the girder as shown in FIG. 3B are evenly distributed symmetrically in the up/down and left/right sides so that the tension force by the tension or non-tension steel wires 26, 27 or 27a are evenly distributed throughout the entire portion of the girder 40.

FIG. 5 shows the arrangement of the steel wires in the lengthwise direction in the girder of FIG. 3A and a cut-open portion located in the middle of the girder. The tension steel wires 26 and the non-tension steel wires 27 provided inside the girder 40 are concentrated in the lower portion at the middle portion of the girder 40 and evenly distributed throughout the entire sectional portion of the girder 40 at both end portions of the girder 40. The tension and non-tension steel wires 26 and 27 are fixed at both ends of the girder 40 by a fixing means 32 which is an anchoring device. The fixing member 32 is covered with concrete (not shown) after the girder 40 is constructed.

Here, when the girders are installed having intervals therebetween, or when a portion of the end of the girder is cut away, as shown in the drawing, a space is formed between the adjacent girders. Thus, a tensioning work can be performed in the space when the tension and non-tension steel wires 26 and 27 are to be re-tensioned later. However, in this case, the end portion of the girder 40 must not be covered with concrete.

Here, one end of the non-tension steel wires 26 and 27 is exposed at either end portions of the girder 40 to apply a tension force.

Also, in a preferred embodiment, the girder is provided with a cut-open portion 36 for adjusting the tension force of the non-tension steel wires 27 at the middle portion of the girder or at another appropriated position. The cut-open portion 36 is used as a space for accommodating a coupling member of the non-tension steel wires 27. That is, the cut-open portion 36 is used as a working space for adjusting the tension force of the non-tension steel wires 27 later.

When cracks 34 or excessive sagging 35 indicated by a dotted line is generated to the girder 40 according to the present invention, as shown in FIG. 5, one or more non-tension steel wires 27 and 27a installed inside or outside the girder 40 are additionally tensioned for reinforcement. Here, the additional tensioning work for the non-tension steel wires 27 and 27a is performed using a hydraulic jack. Also, the tension forces of the non-tension steel wires 27 and 27a are adjusted during or after slab casting and after construction, the tension force is adjusted while the bridge is in use. That is, in the case of a continuous bridge, re-tensioning can be performed before slab casting. However, in the present invention, the re-tensioning is performed shortly after the slab casting before slab concrete is hardened to prevent application of a tension force on the slab.

FIG. 6 shows a preferred embodiment of fixing the steel wire at the end portion of the girder. The steel wire 26 is anchored using a support member 50 as an anchoring device. For example, the steel wires 26 is inserted into a hole formed at the center of the support member 50 at one end of the girder 40. A plurality of wedges 52 are inserted between the steel wire 26 and the support member 50. Here, the steel wire 26 is tensioned by a hydraulic jack and the tensioned steel wire 26 is fixed by the wedges 52.

FIG. 7 shows that steel wires are coupled by the coupling member as a preferred embodiment of a steel wire connection in the cut-open portion. As shown in the drawing, the cut-open portion 36 is formed in the

middle of the bottom surface of the girder 40 in the lengthwise direction. The steel wires 26 fixed at both ends of the girder 40 are connected to a coupling member 62 such that forces of different directions are applied. Here, the tension steel wire 26 to be connected at the coupling member 62  
5 is connected using the support member 50 and the wedges 52.

Thus, the non-tension steel wires 27 connected to each other by the coupling member 62 is tensioned and fixed by using the wedges 52 so that the tension force by the tension steel wire 26 can be maintained. Also, by applying a tension force to the non-tension steel wires 27 and 27a provided  
10 at left and right sides of the girder 40, bending of the girder 40 to the left or right can be compensated for.

According to the arrangement of steel wires and the coupling apparatus the present invention, when a bridge is constructed or at an initial stage of construction, the steel wires 26 and 27 are connected to the  
15 coupling member 62 to be capable of moving to a degree, while the steel wires installed outside the girder 40 are not tensioned at all or tensioned by a small tension force so as to increase the tension forces of the steel wire later.

Although a bridge is described as an example in the above preferred  
20 embodiment, the tension force adjustable prestressed according to the present invention can be applied to other concrete structure such as a building as another preferred embodiment.

It is noted that the present invention is not limited to the preferred embodiment described above, and it is apparent that variations and  
25 modifications by those skilled in the art can be effected within the spirit and scope of the present invention defined in the appended claims.

#### Industrial Applicability

As described above, according to the present invention, cracks and  
30 sagging of a bridge generated due to long-term deterioration, creep or overload can be corrected by additionally tensioning steel wires installed internally or externally at a girder of the bridge. Thus, repair and

reinforcement of the bridge is easy so that the load-resisting force of the bridge can be easily increased. Also, by adjusting the tension force step by step, the girder can be economically manufactured or the height of the girder can be decreased.

What is claimed is:

1. A tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge or building installed thereon, a body portion, and a lower  
5 flange, said prestressed girder comprising:

tension steel wires provided in a lengthwise direction of said girder and tensioned to compensate for said load-resisting force; and

- at least one or more non-tension steel wires provided in the lengthwise direction of said girder, so that the load-resisting force of said  
10 bridge or building can be increased by tensioning said non-tension steel wires.

2. The tension force adjustable prestressed girder as claimed in claim 1, further comprising a cut-open portion at a predetermined portion,  
15 in the lengthwise direction of said girder and a coupling member installed at said cut-open portion for fixing one ends of said steel wires of which the other ends are fixed at an end portion of said girder.

3. The tension force adjustable prestressed girder as claimed in claim 1, wherein said coupling member comprises a support member having holes formed therein through which one ends of said steel wires  
20 having the other ends thereof fixed at an end portion of said girder penetrate, and wedges inserted between said steel wire and said support member.

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4. The tension force adjustable prestressed girder as claimed in claim 1, wherein one end of said non-tension steel wire is exposed at either end portions of said girder to apply a tension force.

- 30 5. A tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge or building installed thereon, a body portion, and a lower

flange, said prestressed girder comprising:

tension steel wires provided in a lengthwise direction of said girder and tensioned to compensate for said load-resisting force; and

one or more non-tension steel wires provided in the lengthwise  
5 direction of said girder, so that the load-resisting force of said bridge or building can be increased by tensioning said non-tension steel wires during construction of said girder and/or after the construction thereof.

6. The tension force adjustable prestressed girder as claimed in  
10 claim 5, wherein, during construction, a tension force of said non-tension steel wires is adjusted during or after slab casting, and, after the construction, the tension force of said non-tension steel wires is adjusted while said bridge or building is being used.



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 99/00567

## A. CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: E 04 C 3/26; E 04 C 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
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☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

14 January 2000 (14.01.00)

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR 99/00567

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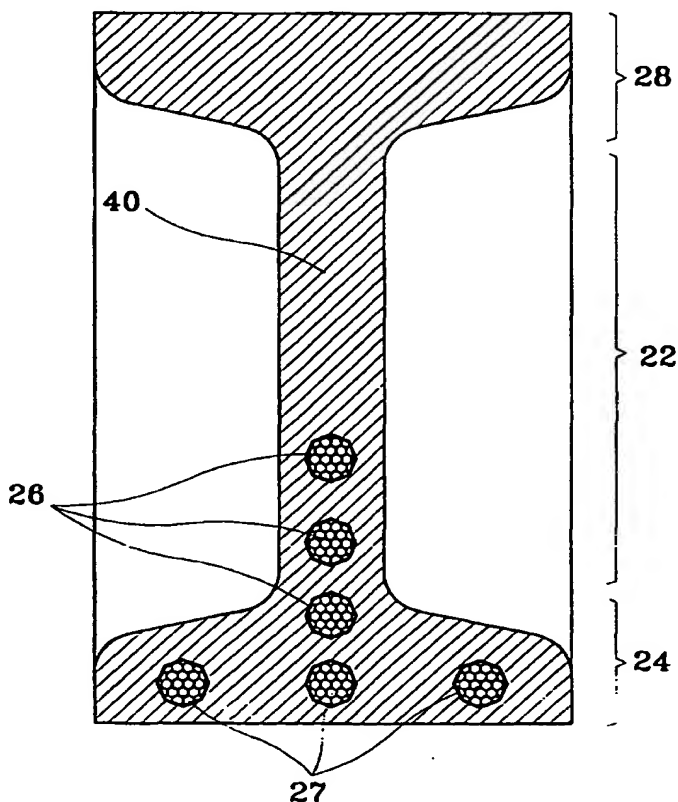
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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|---|--|--|--|
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|   |  |  | (43) International Publication Date:<br>18 May 2000 (18.05.00) |
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(54) Title: TENSION FORCE ADJUSTABLE PRESTRESSED GIRDER

## (57) Abstract

A tension force adjustable prestressed girder is disclosed which can compensate for sagging or cracks of a girder generated due to overload or long-term creep or increase a load-resisting force of a bridge or a building. The tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange (28) supporting an upper deck of a bridge installed thereon, a body portion (22), and a lower flange (24) which includes tension steel wires (27) provided in a lengthwise direction of the girder (40) and tensioned to compensate for the load-resisting force, and at least one or more non-tension steel wires (27a) provided in the lengthwise direction of the girder, so that the load-resisting force of the bridge or building can be increased by tensioning the non-tension steel wires. Thus, cracks and sagging of a girder generated due to long-term deterioration, creep or overload can be corrected by additionally tensioning steel wires installed internally or externally at a girder of the bridge or building. Thus, repair and reinforcement of the bridge or building is easy so that the load-resisting force of the bridge or building can be easily increased. Also, by adjusting the tension force step by step, the girder can be economically manufactured or the height of the girder can be decreased.



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## TENSION FORCE ADJUSTABLE PRESTRESSED GIRDER

### Technical Field

The present invention relates to a girder, and more particularly, to  
5 a tension force adjustable prestressed girder which can compensate for  
sagging or cracks of a girder generated due to a long-term load and is  
capable of adjusting a tension force by increasing a load-resisting force of  
a bridge or building, if necessary, after the construction thereof.

### 10 Background Art

In general, when girders installed on a column of a concrete bridge  
become obsolete as time passes or heavy vehicles exceeding the originally  
designed weight allowance of a bridge pass over the bridge for a prolonged  
period, the beam of the bridge may become damaged and an excessive  
15 sagging may occur at the girders. Concurrently, bending/tensile cracks are  
generated and, when such damage continues, the bridge may ultimately  
collapse. Thus, appropriate repair and reinforcement of the bridge is  
required.

Meanwhile, a prestressed concrete (PSC) bridge is repaired and  
20 reinforced by means of an external steel wire reinforcement construction  
method. According to the above reinforcement construction method, an  
externally installed steel wire is to be fixed appropriately at an end portion  
of a girder. However, it is difficult to install a wire fixing apparatus at the  
end portion of a girder and reliability on the load-resisting force of the wire  
25 fixing apparatus is not assured. Thus, although other methods have been  
suggested and applied, no effective apparatuses have been developed yet.  
That is, when cracks and sagging occur in a PCS bridge, it is very difficult  
to repair and reinforce the bridge.

Also, as the traffic volume continuously increases and automobile  
30 manufacturing technologies develop, the weight of a vehicle increases.  
With an increase in the weight of a vehicle, the specifications which is a  
standard of designing a bridge must be modified. Modifications of the

specifications necessarily results in an unbalanced load-resisting state, i.e., the load-resisting forces of the existing bridges are not matched. In other words, in a state in which roads allowing passage of heavy trucks and roads not allowing passage of heavy trucks exist together, the efficiency of transportation network system as a whole is severely lowered. Thus, to make the unbalanced load-resisting forces of these bridges consistent, an economical reinforcement method for upgrading the level of the bridge from 2 to 1 must be urgently found.

As the width of a road increases due to an increase in the number of lanes of a road, the development of a wide span girder for constructing an elevated road or an overpass crossing a wide road has proceeded. Although a preflex beam has been developed and used for the above purposes, conveying the girder is inconvenient due to the length thereof and because the costs are high.

Currently, high strength concrete is used for a girder less than 30 m long that is not a wide span girder. However, as a high tension force is applied to the girder, the amount of creep generated becomes great. As the creep increases, the girder sags further which directly affects the longitudinal alignment of the road. When the longitudinal alignment deteriorates, a coefficient of impact by passing vehicles increases. Thus, in the case of a high strength girder or a wide span girder, when the girder is used for a long time, an appropriate construction method for compensating for sagging of the girder is required.

Also, the height of a girder which is long in span is relatively high such that the girder itself is 2.00 m - 3.00 m high. Such a fact entails an increase in the height of an upper deck of an overpass so that, to secure a longitudinal alignment of the overpass matching the designed vehicle speed, the length of the overpass becomes longer, thus raising the construction costs. In the case of a bridge crossing a river, to lower the height of the girder as low as possible is inevitably needed for improving the usability and the economic value of the girder.

FIG. 1 shows the structure of a general bridge. As shown in the

drawing, a plurality of I-type girders 12 are installed on a column 10. An upper deck slab (not shown) is installed on the girders 12 of the bridge.

FIG. 2 is a sectional view showing a girder in which steel wires are arranged according to the conventional technology. As shown in the drawing, a girder 20 consists of a body portion 22, an upper flange 28, and a lower flange 24. A plurality of steel wires 26 are built in the body portion 22 in the lengthwise direction. An upper deck of a bridge is installed on the upper flange 28 and the bottom surface of the lower flange 24 is supported by the column 10.

After the I-type girder 20 according to the conventional technology is constructed, when the bridge is damaged, that is, sagging or cracks are generated due to the increased traffic volume passing over the bridge, or when the designed passage load must be increased according to the revision of the specifications, reinforcement of the bridge is required. However, there are no economical and reliable reinforcement methods applicable therefor.

#### Disclosure of the Invention

It is an objective of the present invention to provide a prestressed girder of which a tension force can be adjusted by adjusting a tension force of a steel wire provided in a body portion or lower flange of the girder to easily increase a load-resisting force of a bridge or building, when excessive sagging or cracks are generated in a girder due to long-term use or when there is a need to increase the load-resisting force of the bridge or building without damaging the bridge or building.

Accordingly, to achieve the above objective, there is provided a tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge installed thereon, a body portion, and a lower flange, which includes tension steel wires provided in a lengthwise direction of the girder and tensioned to compensate for the load-resisting force, and at least one or more non-tension steel wires provided in the lengthwise direction of the

girder, so that the load-resisting force of the bridge can be increased by tensioning the non-tension steel wires.

It is preferred in the present invention that the tension force adjustable prestressed girder further comprises a cut-open portion at a predetermined portion in the lengthwise direction of the girder and a coupling member installed at the cut-open portion for fixing one ends of the steel wires of which the other ends are fixed at an end portion of the girder.

According to another preferred embodiment of the present invention, there is provided a tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge installed thereon, a body portion, and a lower flange, which includes tension steel wires provided in a lengthwise direction of the girder and tensioned to compensate for the load-resisting force, and one or more non-tension steel wires provided in the lengthwise direction of the girder, so that the load-resisting force of the bridge can be increased by tensioning the non-tension steel wires during construction of the girder and/or after the construction thereof.

Although the present invention can be applied to any type of girder regardless of the shape of the section of the girder such as an I-type girder or a bulb T-type girder, the I-type girder is described in the below preferred embodiment.

#### Brief Description of the Drawings

FIG. 1 is a perspective view showing the structure of a general bridge;

FIG. 2 is a sectional view showing the arrangement of steel wires in the girder according to conventional technology;

FIG. 3A is a sectional view showing the arrangement of steel wires in the middle portion of a girder according to the present invention;

FIG. 3B is a sectional view showing the steel wires according to another preferred embodiment of the present invention;

FIG. 4A is a sectional view showing the arrangement of steel wires



at the end portion of the girder of FIG. 3A;

FIG. 4B is a sectional view showing the arrangement of steel wires at the end portion of the girder of FIG. 3B;

FIG. 5 is a view showing a cut-open portion located at the middle  
5 portion of the girder and the arrangement of the steel wires in the girder;

FIG. 6 is a side view showing an example of a steel wire fixed at the end portion of the girder; and

FIG. 7 is a perspective view showing an example of the steel wires in the cut-open portion.

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#### Best mode for carrying out the Invention

In FIG. 3A, a girder 40 includes an upper flange 28, a lower flange 24, and a body portion 22. One or more tension steel wires 26 and non-tension steel wires 27 are built in and across the lower portion of the body  
15 portion 22 and the lower flange 24 of the girder 40 in the lengthwise direction of the girder 40.

Preferably, the non-tension steel wires 27 are built in the lower flange 28 horizontally parallel to each other, as shown in FIG. 3A. The upper flange 28 is provided above the body portion 22 in the latitudinal  
20 direction in the section of the girder 40 and an upper deck of a bridge is installed on the upper flange 28. The lower flange 24 is provided below the body portion 22 in the latitudinal direction in the section of the girder 40 and the bottom surface thereof is supported by a column (not shown).

FIG. 3B shows a steel wire according to another preferred  
25 embodiment of the present invention. As shown in the drawing, a plurality of non-tension steel wires 27a are provided in the lengthwise direction of the girder 40 outside the lower portion of the body portion 22. The non-tension steel wires 27a have the same function as that of the non-tension steel wire 27 provided in the lower flange 24, as shown in FIG. 3A. That is,  
30 after a bridge is constructed, sagging of the girder 40 is compensated for by tensioning the non-tension steel wires 27a. Also, the non-tension steel wires 27a can be more easily installed compared to a case of being

installed inside the lower flange 24.

FIG. 4A shows the arrangement of the steel wires built in the girder of FIG. 3A. As shown in the drawing, the tension steel wires 26 and the non-tension steel wires 27 concentrated at the lower portion of the girder 40 are distributed throughout the entire sectional portion of the girder 40. That is, the steel wires are evenly distributed symmetrically in up/down and left/right sides of the girder 40 so that the tension force by the tension steel wires 26 and the non-tension steel wires 27 can be evenly distributed throughout the entire portion of the girder 40.

FIG. 4B shows the arrangement of the steel wires at the end portion of the girder shown in FIG. 3B. As shown in the drawing, the tension steel wires 26 or the non-tension steel wires 27 and 27a concentrated at the lower portion of the girder as shown in FIG. 3B are evenly distributed symmetrically in the up/down and left/right sides so that the tension force by the tension or non-tension steel wires 26, 27 or 27a are evenly distributed throughout the entire portion of the girder 40.

FIG. 5 shows the arrangement of the steel wires in the lengthwise direction in the girder of FIG. 3A and a cut-open portion located in the middle of the girder. The tension steel wires 26 and the non-tension steel wires 27 provided inside the girder 40 are concentrated in the lower portion at the middle portion of the girder 40 and evenly distributed throughout the entire sectional portion of the girder 40 at both end portions of the girder 40. The tension and non-tension steel wires 26 and 27 are fixed at both ends of the girder 40 by a fixing means 32 which is an anchoring device. The fixing member 32 is covered with concrete (not shown) after the girder 40 is constructed.

Here, when the girders are installed having intervals therebetween, or when a portion of the end of the girder is cut away, as shown in the drawing, a space is formed between the adjacent girders. Thus, a tensioning work can be performed in the space when the tension and non-tension steel wires 26 and 27 are to be re-tensioned later. However, in this case, the end portion of the girder 40 must not be covered with concrete.

Here, one end of the non-tension steel wires 26 and 27 is exposed at either end portions of the girder 40 to apply a tension force.

Also, in a preferred embodiment, the girder is provided with a cut-open portion 36 for adjusting the tension force of the non-tension steel wires 27 at the middle portion of the girder or at another appropriated position. The cut-open portion 36 is used as a space for accommodating a coupling member of the non-tension steel wires 27. That is, the cut-open portion 36 is used as a working space for adjusting the tension force of the non-tension steel wires 27 later.

When cracks 34 or excessive sagging 35 indicated by a dotted line is generated to the girder 40 according to the present invention, as shown in FIG. 5, one or more non-tension steel wires 27 and 27a installed inside or outside the girder 40 are additionally tensioned for reinforcement. Here, the additional tensioning work for the non-tension steel wires 27 and 27a is performed using a hydraulic jack. Also, the tension forces of the non-tension steel wires 27 and 27a are adjusted during or after slab casting and after construction, the tension force is adjusted while the bridge is in use. That is, in the case of a continuous bridge, re-tensioning can be performed before slab casting. However, in the present invention, the re-tensioning is performed shortly after the slab casting before slab concrete is hardened to prevent application of a tension force on the slab.

FIG. 6 shows a preferred embodiment of fixing the steel wire at the end portion of the girder. The steel wire 26 is anchored using a support member 50 as an anchoring device. For example, the steel wires 26 is inserted into a hole formed at the center of the support member 50 at one end of the girder 40. A plurality of wedges 52 are inserted between the steel wire 26 and the support member 50. Here, the steel wire 26 is tensioned by a hydraulic jack and the tensioned steel wire 26 is fixed by the wedges 52.

FIG. 7 shows that steel wires are coupled by the coupling member as a preferred embodiment of a steel wire connection in the cut-open portion. As shown in the drawing, the cut-open portion 36 is formed in the

middle of the bottom surface of the girder 40 in the lengthwise direction. The steel wires 26 fixed at both ends of the girder 40 are connected to a coupling member 62 such that forces of different directions are applied. Here, the tension steel wire 26 to be connected at the coupling member 62  
5 is connected using the support member 50 and the wedges 52.

Thus, the non-tension steel wires 27 connected to each other by the coupling member 62 is tensioned and fixed by using the wedges 52 so that the tension force by the tension steel wire 26 can be maintained. Also, by applying a tension force to the non-tension steel wires 27 and 27a provided  
10 at left and right sides of the girder 40, bending of the girder 40 to the left or right can be compensated for.

According to the arrangement of steel wires and the coupling apparatus the present invention, when a bridge is constructed or at an initial stage of construction, the steel wires 26 and 27 are connected to the  
15 coupling member 62 to be capable of moving to a degree, while the steel wires installed outside the girder 40 are not tensioned at all or tensioned by a small tension force so as to increase the tension forces of the steel wire later.

Although a bridge is described as an example in the above preferred  
20 embodiment, the tension force adjustable prestressed according to the present invention can be applied to other concrete structure such as a building as another preferred embodiment.

It is noted that the present invention is not limited to the preferred embodiment described above, and it is apparent that variations and  
25 modifications by those skilled in the art can be effected within the spirit and scope of the present invention defined in the appended claims.

#### Industrial Applicability

As described above, according to the present invention, cracks and  
30 sagging of a bridge generated due to long-term deterioration, creep or overload can be corrected by additionally tensioning steel wires installed internally or externally at a girder of the bridge. Thus, repair and

reinforcement of the bridge is easy so that the load-resisting force of the bridge can be easily increased. Also, by adjusting the tension force step by step, the girder can be economically manufactured or the height of the girder can be decreased.

What is claimed is:

1. A tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge or building installed thereon, a body portion, and a lower flange, said prestressed girder comprising:

tension steel wires provided in a lengthwise direction of said girder and tensioned to compensate for said load-resisting force; and

at least one or more non-tension steel wires provided in the lengthwise direction of said girder, so that the load-resisting force of said bridge or building can be increased by tensioning said non-tension steel wires.

2. The tension force adjustable prestressed girder as claimed in claim 1, further comprising a cut-open portion at a predetermined portion in the lengthwise direction of said girder and a coupling member installed at said cut-open portion for fixing one ends of said steel wires of which the other ends are fixed at an end portion of said girder.

3. The tension force adjustable prestressed girder as claimed in claim 1, wherein said coupling member comprises a support member having holes formed therein through which one ends of said steel wires having the other ends thereof fixed at an end portion of said girder penetrate, and wedges inserted between said steel wire and said support member.

4. The tension force adjustable prestressed girder as claimed in claim 1, wherein one end of said non-tension steel wire is exposed at either end portions of said girder to apply a tension force.

5. A tension force adjustable prestressed girder for adjusting a load-resisting force which consists of an upper flange supporting an upper deck of a bridge or building installed thereon, a body portion, and a lower

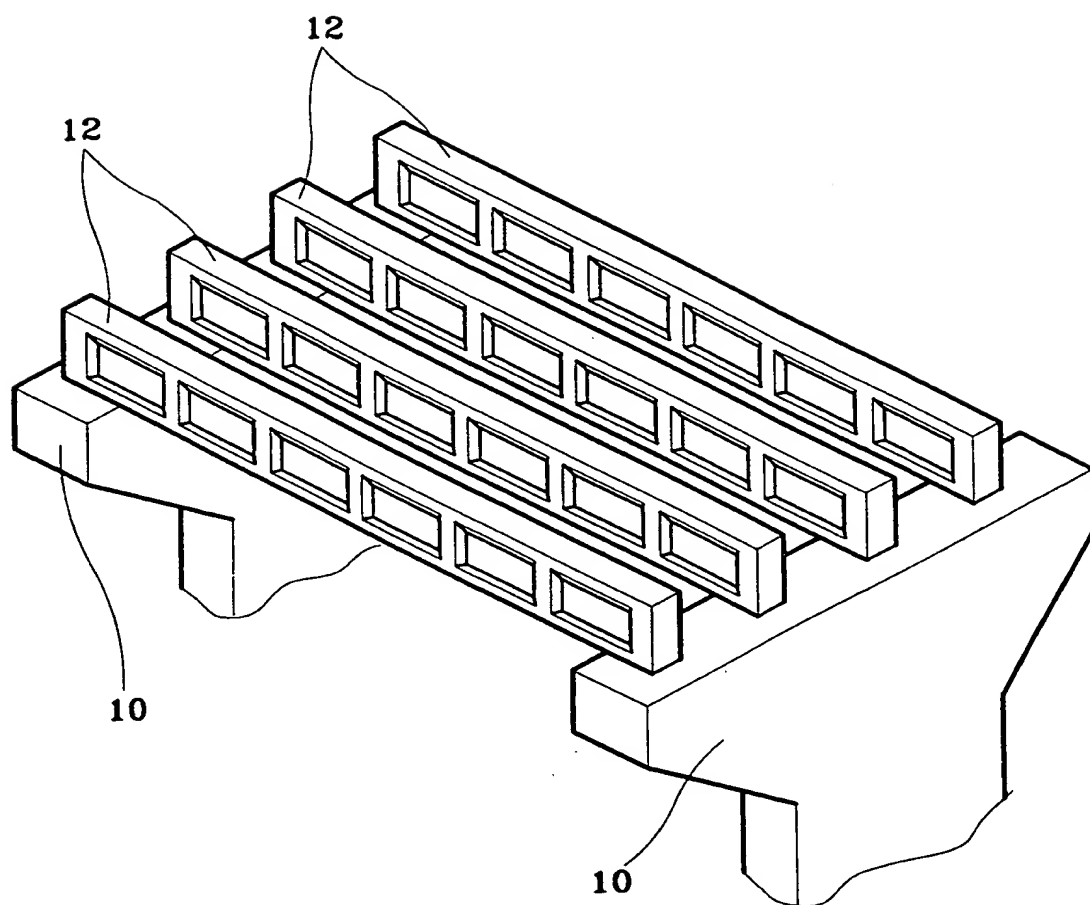
flange, said prestressed girder comprising:

tension steel wires provided in a lengthwise direction of said girder and tensioned to compensate for said load-resisting force; and

one or more non-tension steel wires provided in the lengthwise  
5 direction of said girder, so that the load-resisting force of said bridge or building can be increased by tensioning said non-tension steel wires during construction of said girder and/or after the construction thereof.

6. The tension force adjustable prestressed girder as claimed in  
10 claim 5, wherein, during construction, a tension force of said non-tension steel wires is adjusted during or after slab casting, and, after the construction, the tension force of said non-tension steel wires is adjusted while said bridge or building is being used.

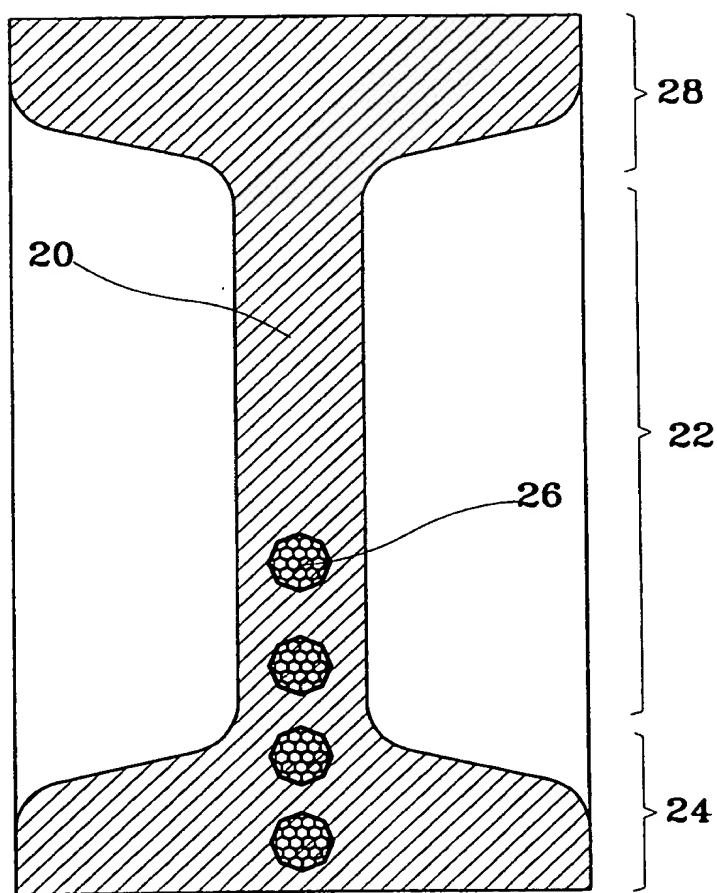
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FIG. 1



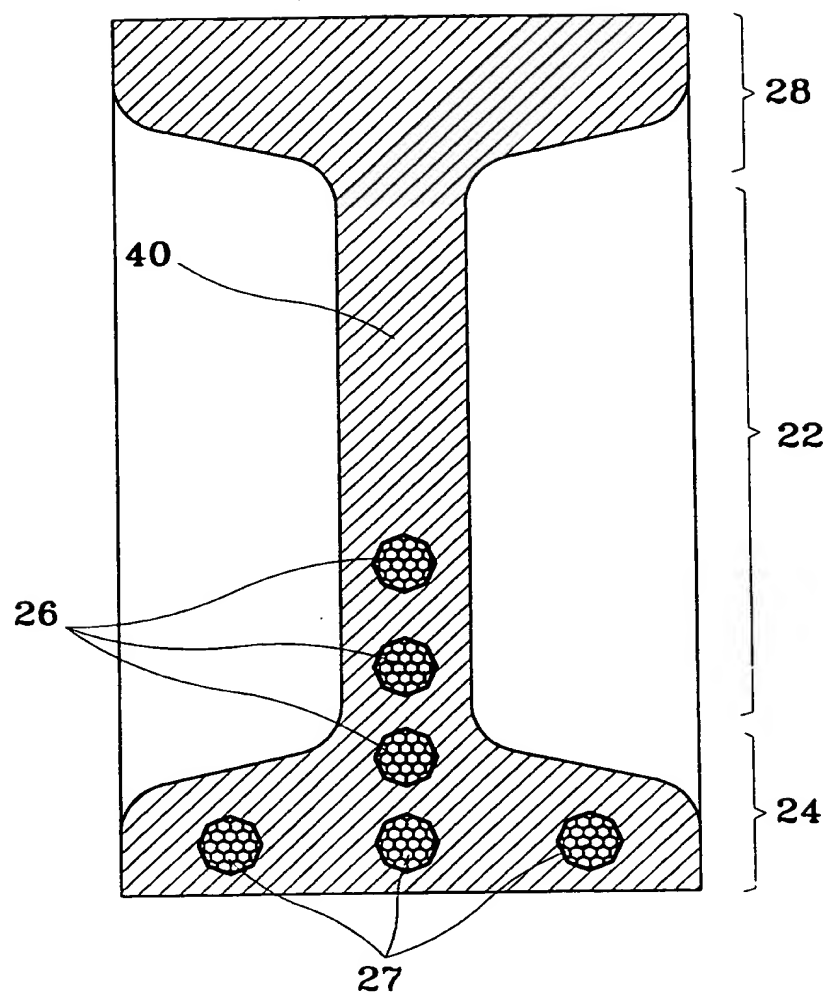


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FIG. 2  
(PRIOR ART)

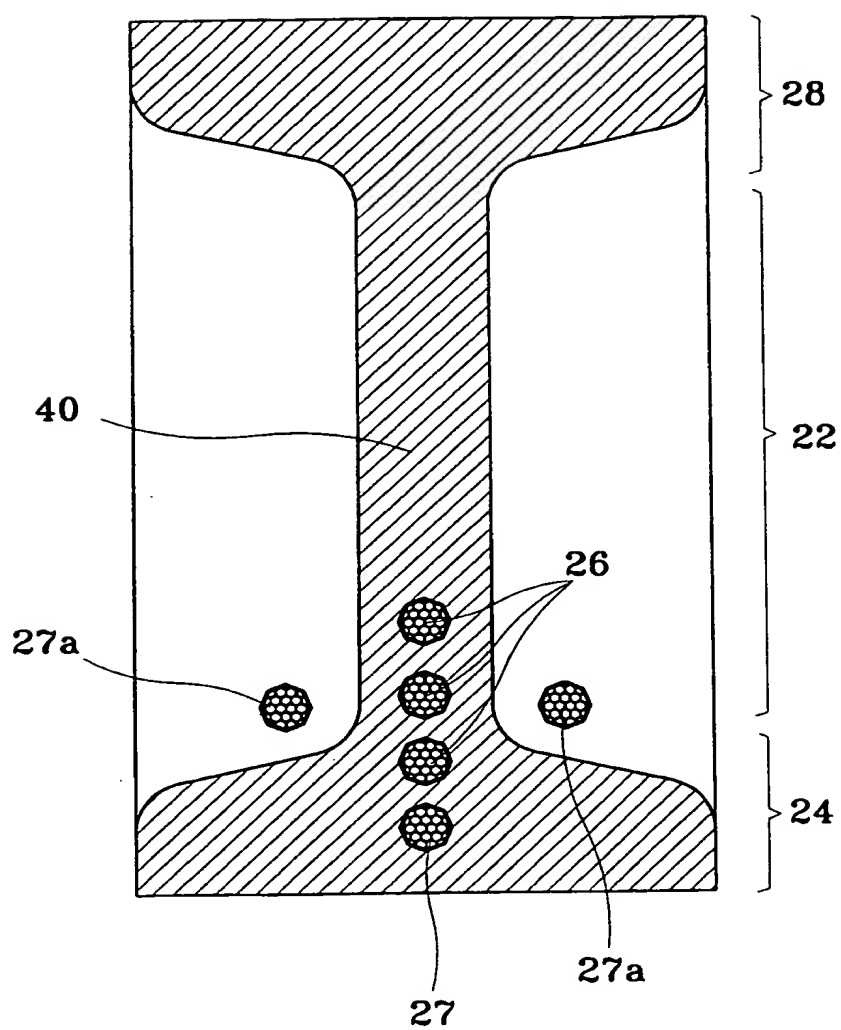


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FIG. 3A



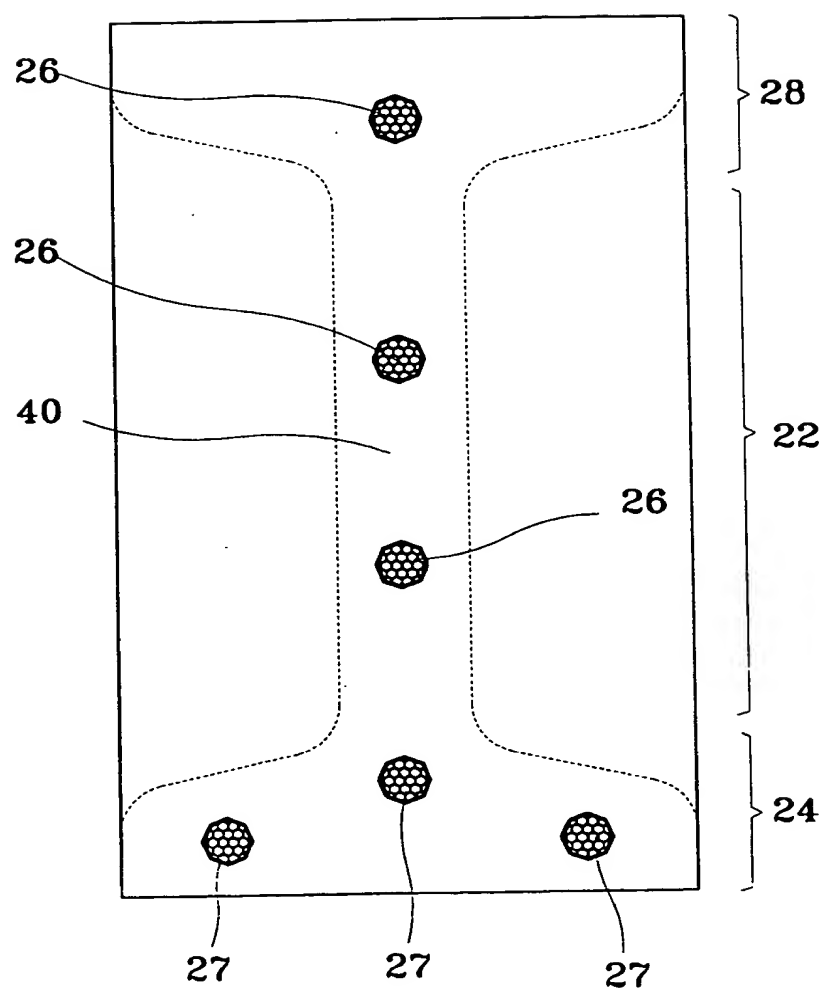
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FIG. 3B



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FIG. 4A



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FIG. 4B

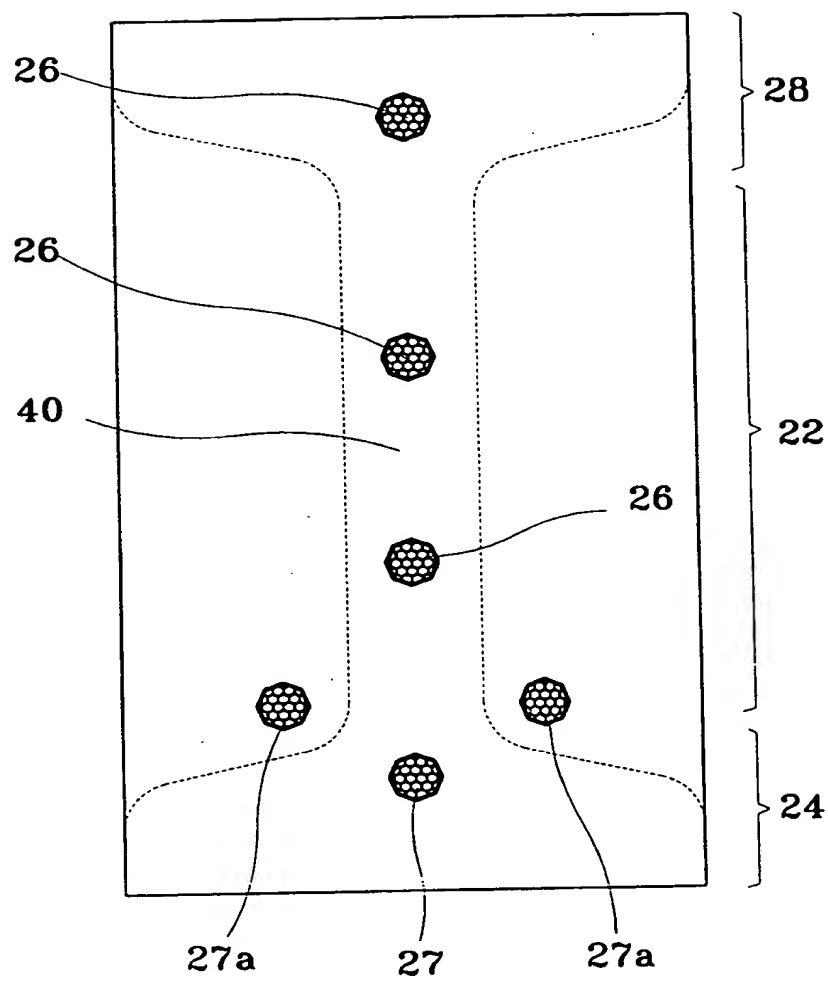
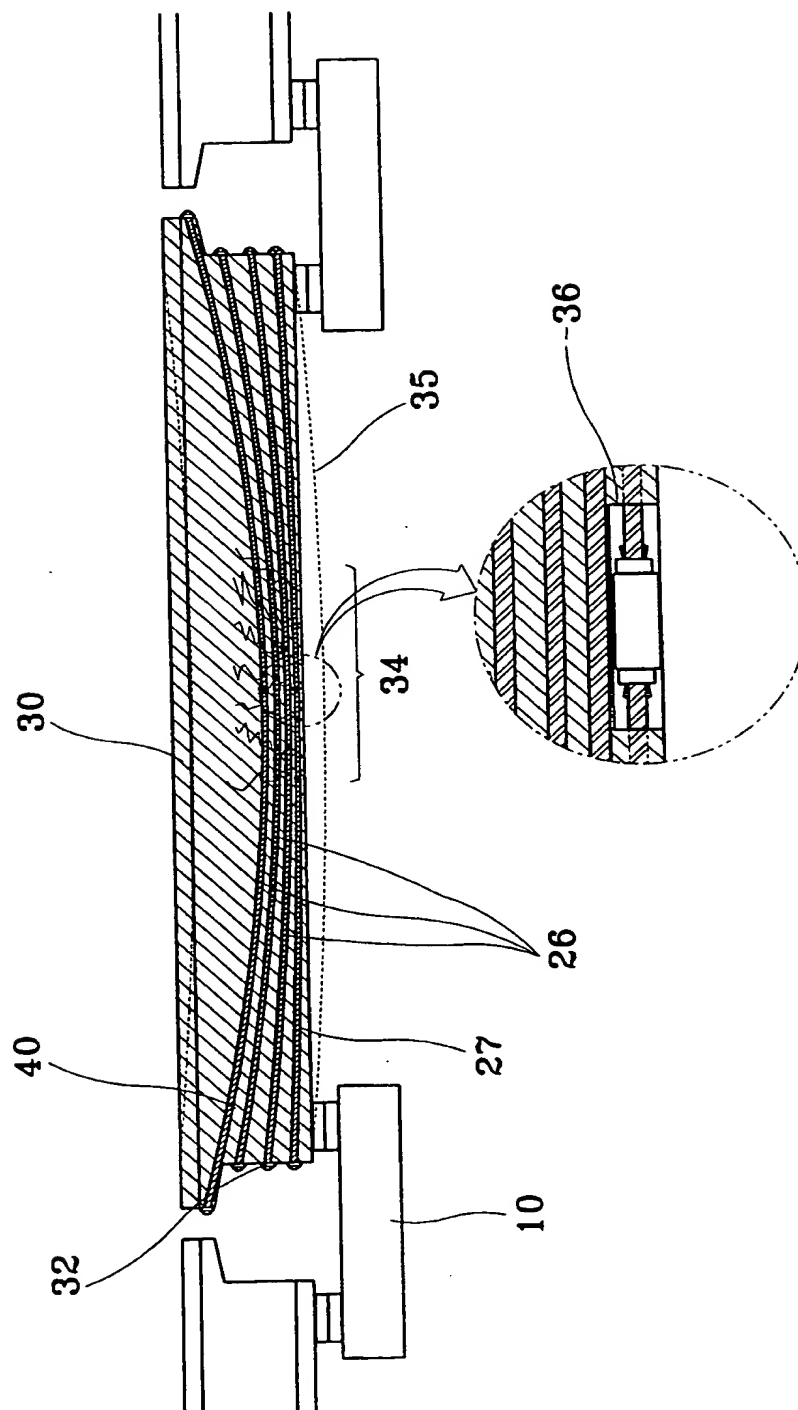


FIG. 5



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FIG. 6

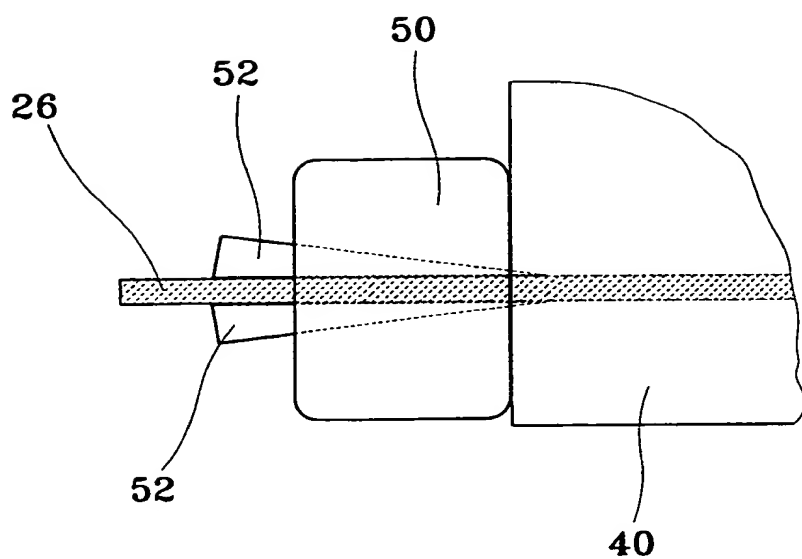
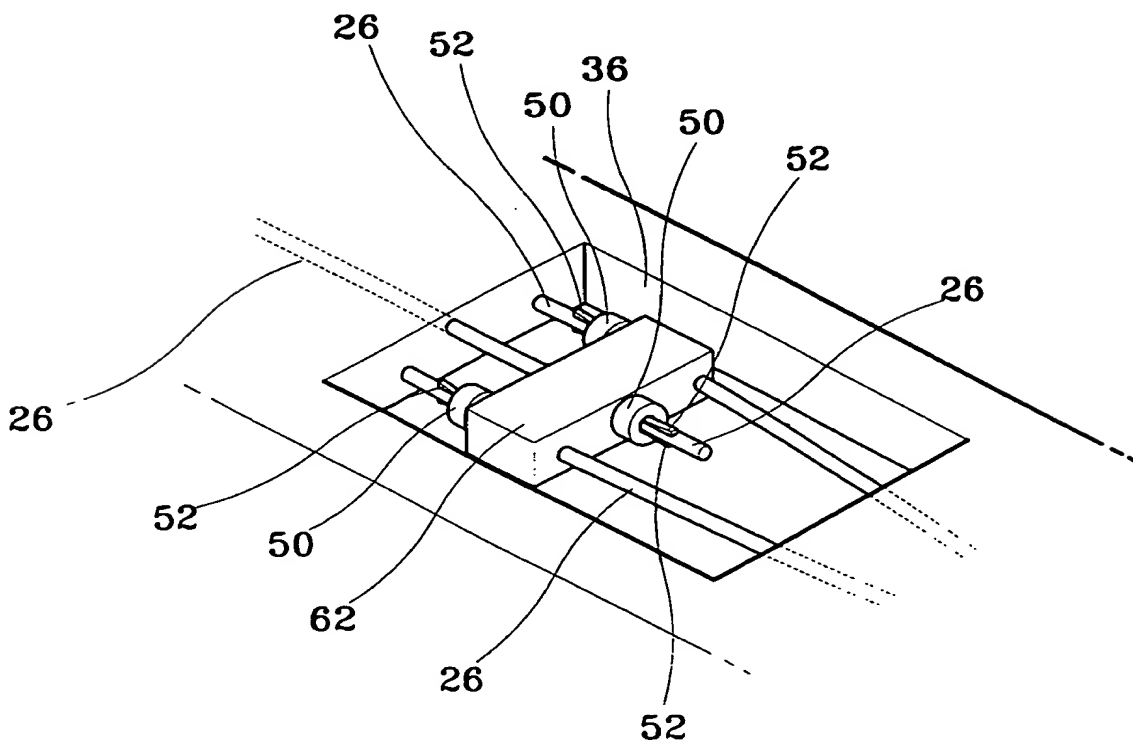


FIG. 7



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 99/00567

## A. CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: E 04 C 3/26; E 04 C 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC<sup>7</sup>: E 04 C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
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☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

14 January 2000 (14.01.00)

Date of mailing of the international search report

09 February 2000 (09.02.00)

Name and mailing address of the ISA/AT

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR 99/00567

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